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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,151	09/26/2003	Keren Jacobs	LAM1P178/P1189	8126
22434	7590	05/30/2006	EXAMINER	
BEYER WEAVER & THOMAS LLP P.O. BOX 70250 OAKLAND, CA 94612-0250			TRAN, BINH X	
			ART UNIT	PAPER NUMBER
			1765	
DATE MAILED: 05/30/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/672,151	Applicant(s) JACOBS ET AL.	
	Examiner Binh X. Tran	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14, 15, 20, 23-29, 32-35 and 37-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 29, 32-35 and 37-41 is/are allowed.
- 6) ☒ Claim(s) 14, 20 and 23-26 is/are rejected.
- 7) ☒ Claim(s) 15, 27 and 28 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 14, 20, 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj (US 6,051,503) in view of Hsieh et al. (US 6,949,203).

Respect to claim 14, Bhardwaj teaches a method for etching a layer through a mask comprising the step of:

placing a substrate in a process chamber (Fig 1);

providing a first etch plasma composition to the process chamber, wherein the

Art Unit: 1765

first etch plasma composition begins to etch a feature in the etch layer (i.e. first cycle of the ramping process);

providing a second etch plasma composition, wherein the second etch plasma composition continues to etch a feature in the etch layer (i.e. second cycle of the ramping process);

providing a third etch plasma composition, wherein the second etch plasma composition continues to etch a feature in the etch layer (third cycle of the ramping process).

Bhardwaj further teaches to increase etch aggressive by increase the etch rate. For example, in Fig 4 Bhardwaj shows the first etch rate of about 100 angstrom/min, the second etch rate of about 200 angstrom/min and the third etch rate of about 400 angstrom/min (See Fig 4 data between 10% to 20% on the x-axis). Since the etch rate is increased between each step, the examiner will interpret that Bhardwaj teaches the third plasma is more aggressive to the second plasma, and the second plasma is more aggressive to the first plasma.

Respect to claim 14, Bhardwaj fails to disclose that the ramping increase etch aggressive with respect to etch stop. However, Bhardwaj clearly teaches an increase in etch aggressive. Hsieh discloses a process to etch layer selectively at a high rate with respect to etch stop (12) (See col. 3 lines 1-20). Hsieh further discloses an increase in active etchant gas will result in an increase in the etch rate with respect to the etch stop layer (Fig 7, i.e. more aggressive with respect to etch stop). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Bhardwaj in

view of Hsieh by increasing etch aggressive with respect to etch stop because it will result in a vertical and very narrow hole

Respect to claim 20, Bhardwaj teaches ramping at least one etching parameter during the etching of the feature to optimize plasma parameters to the changing etch depth and etching with the ramped plasma until the feature is etched to a feature depth (col. 8-9, Fig 9i, 9ii).

Respect to claim 23, Bhardwaj discloses the ramping occurs over a time period of greater than 30 seconds (See Fig 19a-19b; 8 minutes in Fig 19a and 90 min in Fig 19b). Respect to claim 24, Bhardwaj discloses the ramping occurs greater than 50% of the duration of the etch (Fig 9i, 9ii). Respect to claim 25, Bhardwaj discloses the ramping is a non-linear ramping (col. 10 lines 57-60).

Respect to claim 26, Bhardwaj fails to disclose the etch layer is a dielectric layer. In a semiconductor process, Hsieh discloses the etch layer is a dielectric layer (col. 2). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Bhardwaj in view of Hsieh by using dielectric layer because this layer is necessary to protect and insulate the substrate and active structure during semiconductor process.

Allowable Subject Matter

4. Claim 15, 27-28 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. Claims 29, 32-35, 37, 38-41 are allowed.

Art Unit: 1765

6. The following is a statement of reasons for the indication of allowable subject matter: Respect to claims 15, 27-28, the cited prior arts fail to disclose or suggest either of the following limitation: wherein the first etch plasma is more selective than the second etch plasma, and the second etch plasma is more selective than the third plasma etch; or the ramping decreases etch selectivity between the etch layer and the mask. Respect to claims 29, 32-35, 37, 38-41, the cited prior arts fail to disclose that the ramping occurs for at least 30% of the duration of the etch, wherein the ramping is at least one of a continuous ramping and a series of discrete steps that mimic a continuous ramping. The closest prior art (Bhardwaj) teaches that fix parameters process, with high bias and low-pressure conditions degrades the mask selectivity. However, Bhardwaj teaches ramping condition will maintain a high selectivity (col. 9 lines 14-25)

Response to Arguments

7. Respect to independent amended claims 29 and 37, applicants argues that "Bhardwaj does not disclose or make obvious a ramp that is either a continuous ramping or series of discrete steps that mimic a continuous ramping". According to applicants, "Bhardwaj does not provide a continuous ramp but instead ramps cycle by cycle". This argument is persuasive, thus the examiner withdrew the previous rejection.

Respect to claims 14, 21-28, the applicants state that "Fig. 4 is a plot of etch rate of silicon against the percentage of CH₄ and H₂". According to applicants, "the examiner failed to point out anything in Bhardwaj that states that the data between 10% to 20% on the x-axis [of Fig 4] are a first, second and third etch step of an etch process

Art Unit: 1765

of Bhardwaj". The examiner disagrees with this argument. First, the examiner clearly recognize that Bhardwaj does not explicitly use the term "first", "second" or "third" etch to describe Fig 4. However, in col. 5 lines 4-7, Bhardwaj describes Figure 4 by stating "It will be noted that the etch rate increases from an initial steady state with increasing percentage of CH₄ to a peak before decrease to zero". Since the concentration of CH₄ is increasing from initial value, it is obvious that the concentration must be increase with respect with time (i.e. it is impossible to increase the concentration without changing the time scale). Since Bhardwaj teaches the concentration is increase with respect to time, the examiner certainly can interprets three different data points in Figure 4 as "first", "second" and "third".

Respect to claims 15, 27-28, the applicant argument (in page 9 of the remark) is persuasive. Thus, the examiner withdraws the previous ground of rejection.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 1765

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

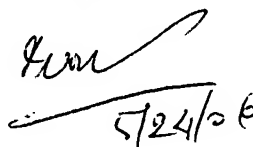
9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Binh X. Tran

DUY-VU N. DEO
PRIMARY EXAMINER



5/24/06